

FORM PTO-1590 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		ATTORNEY'S DOCKET NUMBER: ATMOS.1.US U.S. APPL. NO. (if known, see 37 CFR 1.5) 10/009260
INTERNATIONAL APPLICATION NO.: PCT/GB00/02230	INTERNATIONAL FILING DATE: 8 JUNE 2000	PRIORITY DATE CLAIMED: 9 JUNE 1999
TITLE OF INVENTION: REDUCTION OF OZONE IN AN ENCLOSED ENVIRONMENT		
APPLICANT(S) FOR DO/EO/US: Stuart MAXWELL, Mervyn Napoleon SENNETT and Jonathan Paul MOULTON		
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:		
1. <input checked="" type="checkbox"/>	This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.	
2. <input type="checkbox"/>	This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.	
3. <input checked="" type="checkbox"/>	This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).	
4. <input checked="" type="checkbox"/>	A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.	
5. <input checked="" type="checkbox"/>	A copy of the International Application as filed (35 U.S.C. 371(c)(2))	
a. <input checked="" type="checkbox"/>	is transmitted herewith (required only if not transmitted by the International Bureau).	
b. <input checked="" type="checkbox"/>	has been transmitted by the International Bureau. (see attached copy of PCT/IB/308)	
c. <input type="checkbox"/>	is not required, as the application was filed in the United States Receiving Office (RO/US).	
6. <input type="checkbox"/>	A translation of the International Application into English (35 U.S.C. 371(c)(2)).	
7. <input type="checkbox"/>	Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).	
a. <input type="checkbox"/>	are transmitted herewith (required only if not transmitted by the International Bureau).	
b. <input type="checkbox"/>	have been transmitted by the International Bureau.	
c. <input type="checkbox"/>	have not been made; however, the time limit for making such amendments has NOT expired.	
d. <input type="checkbox"/>	have not been made and will not be made.	
8. <input type="checkbox"/>	A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).	
9. <input type="checkbox"/>	An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).	
10. <input type="checkbox"/>	A translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).	
Item 11. to 16. below concern document(s) or information included:		
11. <input checked="" type="checkbox"/>	An Information Disclosure Statement under 37 CFR 1.97 and 1.98.	
12. <input type="checkbox"/>	An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.	
13. <input checked="" type="checkbox"/>	A FIRST preliminary amendment.	
<input type="checkbox"/>	A SECOND or SUBSEQUENT preliminary amendment.	
14. <input type="checkbox"/>	A substitute specification.	
15. <input type="checkbox"/>	A change of power of attorney and/or address letter.	
16. <input checked="" type="checkbox"/>	Other items or information:	
INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT/IPEA/409), INTERNATIONAL PUBLICATION, INTERNATIONAL SEARCH REPORT (PCT/ISA/210), Forms PCT/IB/304 and PCT/IB/308, ABSTRACT on a separate sheet, APPLICATION DATA SHEET		

U.S. APPLICATION NO. (if known, see 37 CFR 1.55)

107 009260INTERNATIONAL APPLICATION NO.
PCT/GB00/02230ATTORNEY'S DOCKET NO.
ATMOS.1.US17. ☒ The following fees are submitted:**BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)):**

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$ 1,040.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$ 890.00

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$ 740.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$ 710.00

International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$ 100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =

\$ 890.00

Surcharge of \$130.00 for furnishing the oath or declaration later than 30 months from the earliest claimed priority date (37 CFR 1.492(e)).

\$ 130.00

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	\$
Total claims	30 - 20 =	10	X \$18.00	\$ 180.00
Independent claims	3 - 3 =	0	X \$84.00	\$
MULTIPLE DEPENDENT CLAIMS(S) (if applicable)			+ \$280.00	\$

TOTAL OF ABOVE CALCULATIONS =

\$ 1,200.00

Reduction of 1/2, if applicant is entitled to Small Entity status under 37 CFR 1.27.

+

\$

SUBTOTAL =

\$ 1,200.00

Processing fee of \$130 for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492(f)).

\$

TOTAL NATIONAL FEE =

\$ 1,200.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property

+

\$

TOTAL FEES ENCLOSED =

\$ 1,200.00

Amount to be
refunded:

charged:

a. ☒ A check in the amount of \$ **1,200.00** to cover the above fees is enclosed.b. ☐ Please charge my Deposit Account No. **25-0120** in the amount of \$ to cover the above fees. A duplicate copy of this sheet is enclosed.c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required by 37 CFR 1.16 and 1.17, or credit any overpayment to Deposit Account No. **25-0120**. A duplicate copy of this sheet is enclosed.

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December 10, 2001

By

Benoît Castel
Benoît Castel
Attorney for Applicants
Registration No. 35,041

PATENTS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Stuart MAXWELL et al.

Box PCT

Serial No. (unknown)
(PCT/GB00/02230)

Application Branch

Filed herewith

REDUCTION OF OZONE IN
AN ENCLOSED ENVIRONMENT

PRELIMINARY AMENDMENT

Commissioner for Patents

Washington, D.C. 20231

Sir:

Prior to the first Official Action and calculation of the filing fee, please amend the above-identified application as follows:

IN THE CLAIMS:

Claims 3-5, 7-9, 12, 13, 16, 18-22, and 26-30 have been amended as follows:

--3. (amended) A method according to claim 1, which comprises releasing the terpenoid vapour at a rate of between 60 and 100mg per hour. --

--4. (amended) A method according to claim 1, which comprises releasing the terpenoid vapour at a rate of about 80mg per hour.--

--5. (amended) A method according to claim 1, wherein said terpenoid vapour is released by evaporation from an emission element.--

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--7. (amended) A method according to claim 5, wherein said emission element is exposed to natural, unforced ventilation.--

--8. (amended) A method according to claim 5, wherein said emission element is located in a container configurable between an open position, in which the element is exposed to the ambient atmosphere and a closed position in which said element is generally enclosed within a housing.--

--9. (amended) A method according to claim 5 wherein said emission element is a porous synthetic polymer element.--

--12. (amended) A method according to claim 9, in which at least 80% by weight of the particles have a particle size within the range of from 1 to 500 micron.--

--13. (amended) A method according to claim 5, wherein said emission element, before absorption of said terpenoid, weighs from 5 to 15 grams.--

--16. (amended) A method according to claim 5 wherein the void volume of the emission element is in the range of from 25% to 70% of the volume of the emission element.--

--18. (amended) A method according to claim 5 wherein the average pore size of the emission element is between 10 and 100 microns.--

--19. (amended) A method according to claim 1 wherein the or each terpenoid comprises a terpene or a carotenoid.--

--20. (amended) A method as claimed in claim 1, wherein the terpenoid, or at least one of the terpenoids comprises an essential oil.--

--21. (amended) A method according to claim 1, wherein the terpenoid compounds or mixture thereof is selected from the group comprising lavender oil, orange oil, grapefruit oil, lime oil, myrtle oil, coriander oil, tea tree oil, elecampane oil, juniper oil, dill oil, lemon oil, elemi oil, spanish sage oil, cypress oil, pine needle oil, lemon balm (melissa) oil, nutmeg oil, ylang ylang oil, basil oil, grapeseed oil, a phellandrene, a humulene, a terpinene, limonene, a pinene, b caryophyllene, linalool, linalyl acetate.--

--22. (amended) A method according to claim 1, wherein the flash point of the or each terpenoid is at least 60°C.--

--26. (amended) Apparatus according to claim 24, wherein said container comprises an inner housing having perforate walls, said inner housing being movably mounted with respect to an outer housing.--

--27. (amended) Apparatus according to claim 24, wherein said emission element comprises a porous polymer substrate impregnated with said terpenoid compound.--

--28. (amended) Apparatus according to claim 24,
wherein said terpenoid compound comprises linalool.--

--29. (amended) Apparatus according to claim 24
wherein said emission element contains between 10 and 20 grams
of linalool.--

--30. (amended) Apparatus according to claim 24,
wherein said emission element has a void volume of between 25%
and 70% and an average pore size of between 10 and 100
microns.--

R E M A R K S

The above changes in the claims merely place this
national stage application in the same condition as it was
during Chapter II of the international stage, with the
multiple dependencies being removed.

Attached hereto is a marked-up version of the
changes made to the claims by the current amendment. The
attached page is captioned "VERSION WITH MARKINGS TO SHOW
CHANGES MADE."

Respectfully submitted,

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December 10, 2001

VERSION WITH MARKINGS TO SHOW CHANGES MADE

Claims 3-5, 7-9, 12, 13, 16, 18-22, and 26-30 have been amended as follows:

--3. (amended) A method according to ~~Claim~~^{claim} 1 or ~~Claim 2~~, which comprises releasing the terpenoid vapour at a rate of between 60 and 100mg per hour. --

--4. (amended) A method according to ~~any of the preceding Claims~~^{claim}, which comprises releasing the terpenoid vapour at a rate of about 80mg per hour.--

--5. (amended) A method according to ~~any of the preceding claims~~^{claim} 1, wherein said terpenoid vapour is released by evaporation from an emission element.--

--7. (amended) A method according to ~~Claim~~^{claim} 5 or ~~6~~, wherein said emission element is exposed to natural, unforced ventilation.--

--8. (amended) A method according to ~~any of Claims~~^{claim} 5 to ~~7~~, wherein said emission element is located in a container configurable between an open position, in which the element is exposed to the ambient atmosphere and a closed position in which said element is generally enclosed within a housing.--

--9. (amended) A method according to ~~any of claims~~^{claim} 5 to ~~8~~ wherein said emission element is a porous synthetic polymer element.--

--12. (amended) A method according to ~~Claim~~^{claim} 9 or ~~Claim 10~~, in which at least 80% by weight of the particles have a particle size within the range of from 1 to 500 micron.--

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--13. (amended) A method according to ~~any of Claimsclaim 5 to 12~~, wherein said emission element, before absorption of said terpenoid, weighs from 5 to 15 grams.--

--16. (amended) A method according to ~~any of Claimsclaim 5 to 15~~ wherein the void volume of the emission element is in the range of from 25% to 70% of the volume of the emission element.--

--18. (amended) A method according to ~~any of the preceding Claimsclaim 5~~ wherein the average pore size of the emission element is between 10 and 100 microns.--

--19. (amended) A method according to ~~any of the preceding Claimsclaim 1~~ wherein the or each terpenoid comprises a terpene or a carotenoid.--

--20. (amended) A method as claimed in ~~any of the preceding Claimsclaim 1~~, wherein the terpenoid, or at least one of the terpenoids comprises an essential oil.--

--21. (amended) A method according to ~~any of the preceding claimsclaim 1~~, wherein the terpenoid compounds or mixture thereof is selected from the group comprising lavender oil, orange oil, grapefruit oil, lime oil, myrtle oil, coriander oil, tea tree oil, elecampane oil, juniper oil, dill oil, lemon oil, elemi oil, spanish sage oil, cypress oil, pine needle oil, lemon balm (melissa) oil, nutmeg oil, ylang ylang oil, basil oil, grapeseed oil, a phellandrene, a humulene, a terpinene, limonene, a pinene, b caryophyllene, linalool, linalyl acetate.--

--22. (amended) A method according to ~~any of the preceding Claimsclaim 1~~, wherein the flash point of the or each terpenoid is at least 60°C.--

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--26. (amended) Apparatus according to ~~Claim~~
~~24 or Claim 25~~, wherein said container comprises an inner housing having perforate walls, said inner housing being movably mounted with respect to an outer housing.--

--27. (amended) Apparatus according to ~~any of~~
~~Claims~~~~claim 24 to 26~~, wherein said emission element comprises a porous polymer substrate impregnated with said terpenoid compound.--

--28. (amended) Apparatus according to ~~any of~~
~~Claims~~~~claim 24 to 27~~, wherein said terpenoid compound comprises linalool.--

--29. (amended) Apparatus according to ~~any of~~
~~Claims~~~~claim 24 to 28~~ wherein said emission element contains between 10 and 20 grams of linalool.--

--30. (amended) Apparatus according to ~~any of~~
~~Claims~~~~claim 24 to 29~~, wherein said emission element has a void volume of between 25% and 70% and an average pore size of between 10 and 100 microns.--

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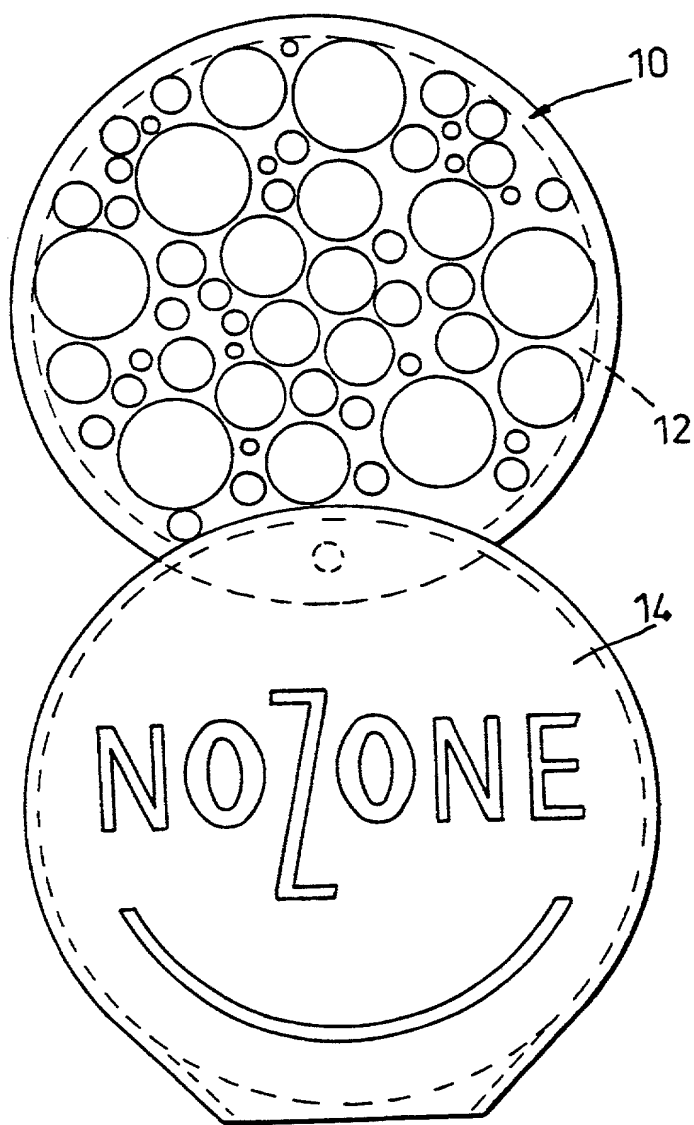


Fig. 1

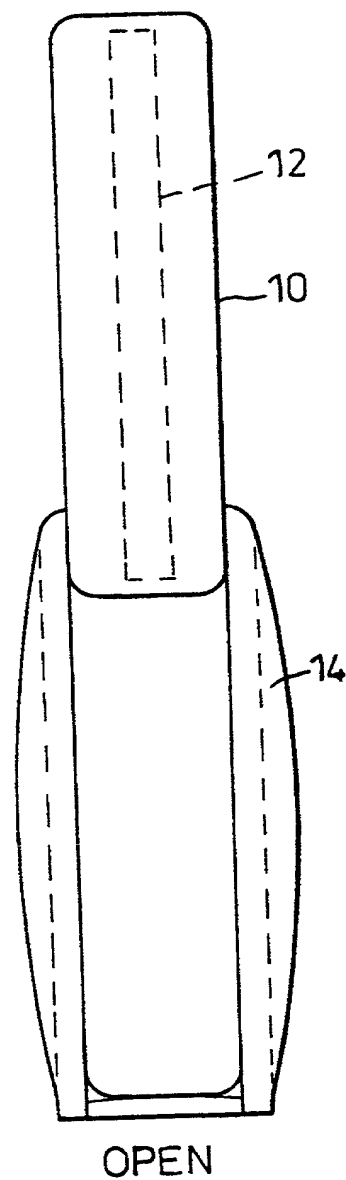


Fig. 2

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REF: O3_CHART 1
VYON 4.75mm LINALOOL

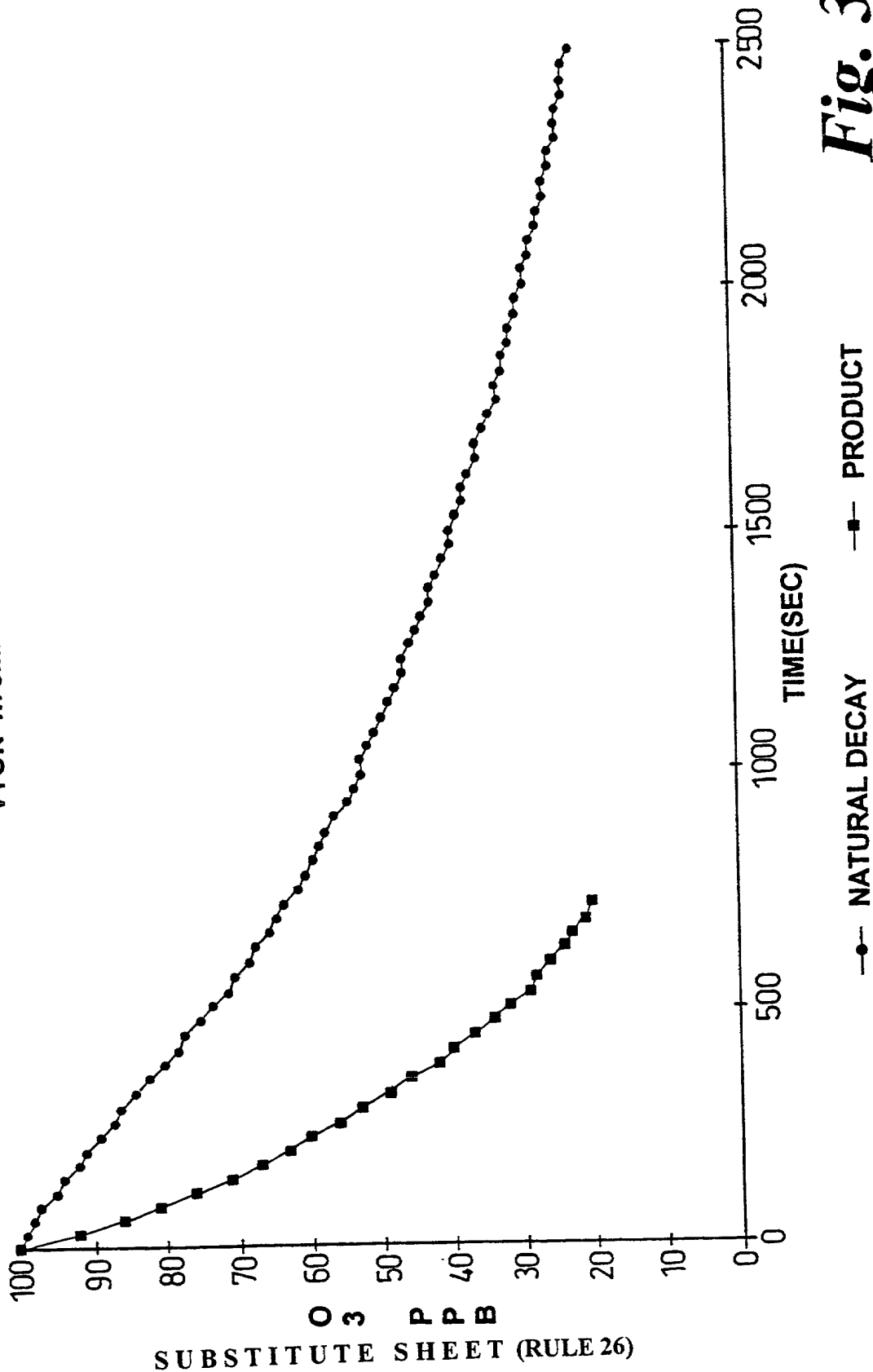


Fig. 3

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REF: O3_9/CHART 2 18/1/99
LINALOOL ON VYON E AFTER 72 HOURS

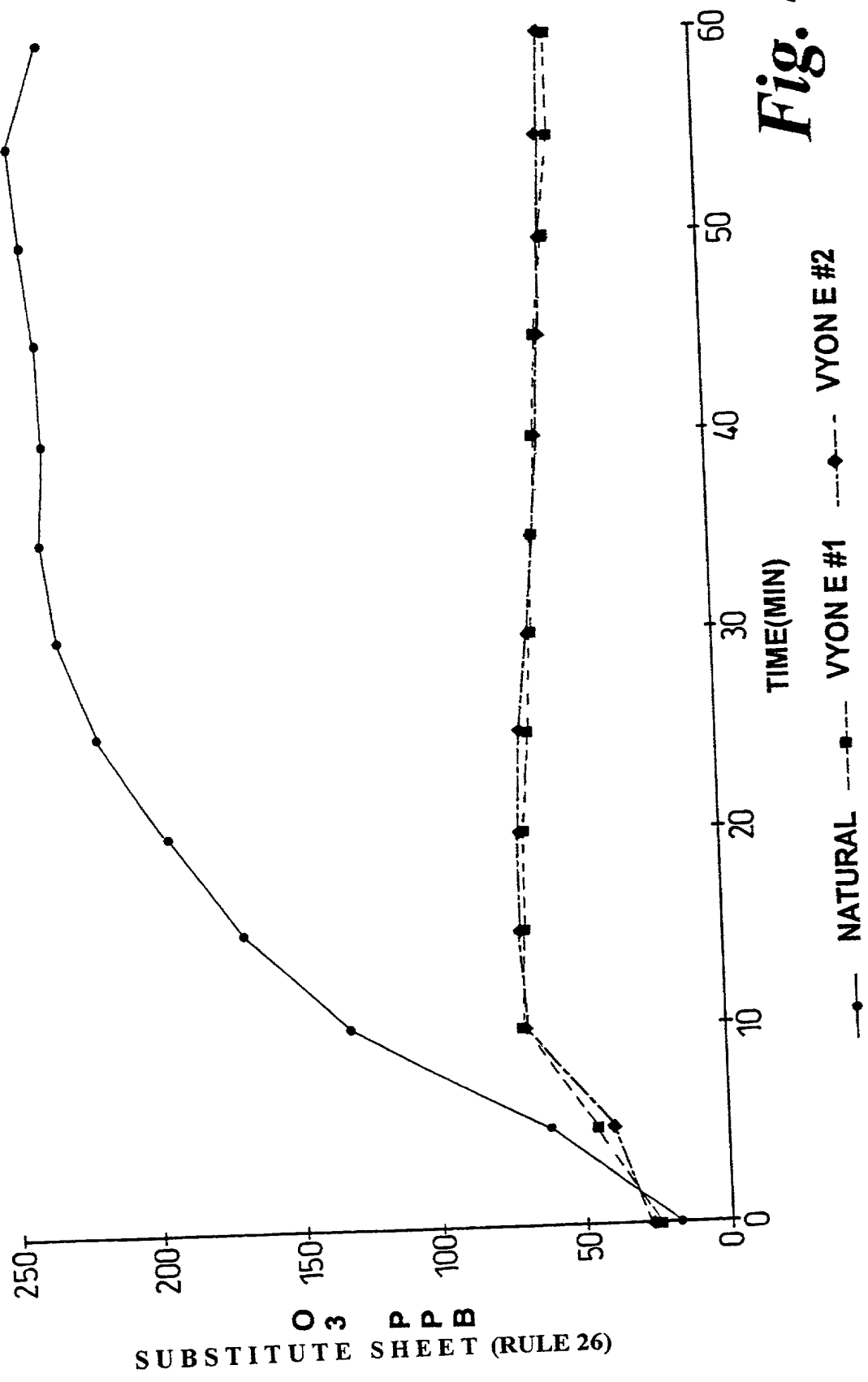


Fig. 4(a)

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REF: O3_9/CHART 3 19/1/99
LINALOOL ON VYON E AFTER 96 HOURS

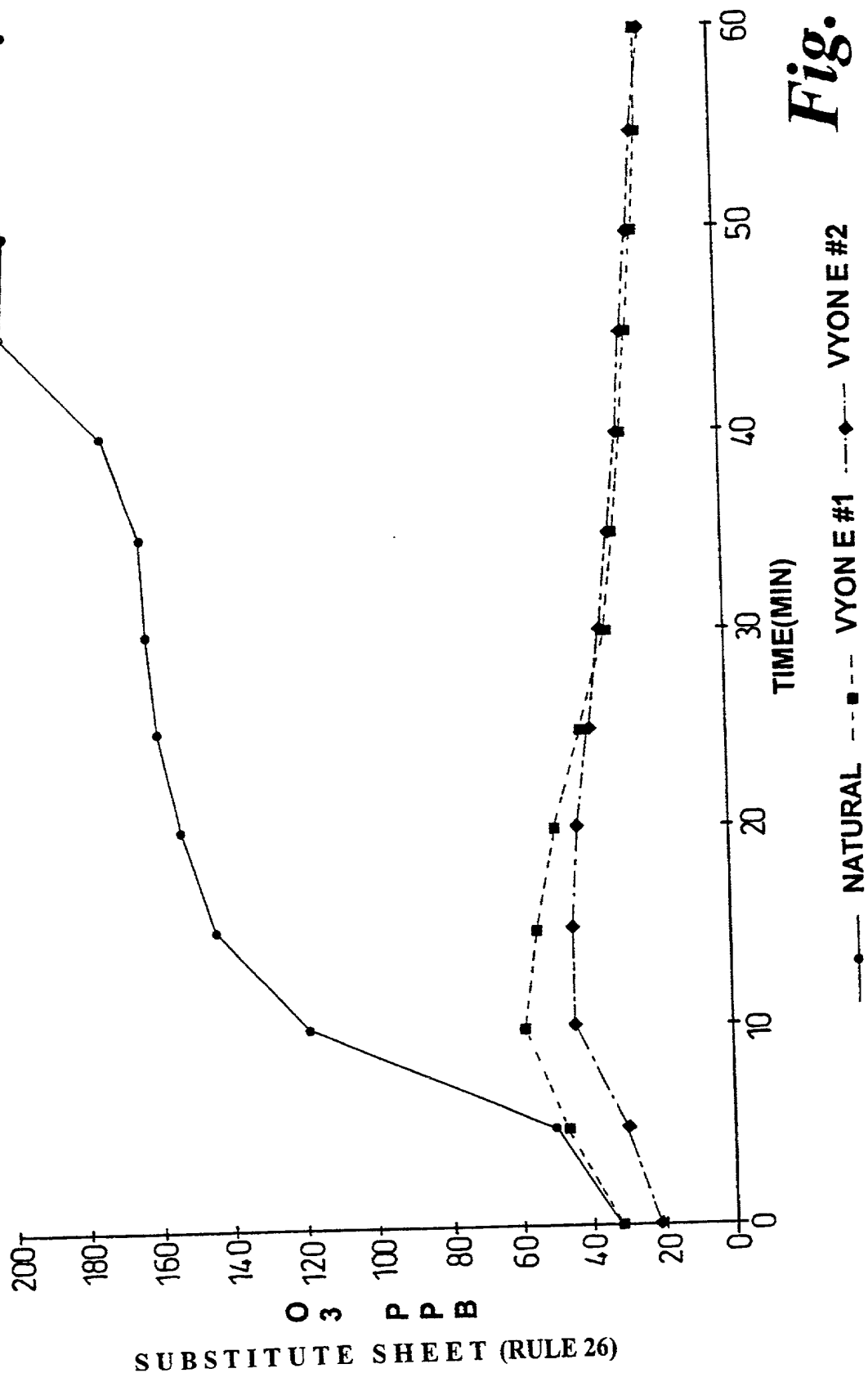


Fig. 4(b)

REF: O3_9/CHART 4 20/1/99
LINALOOL ON VYON E AFTER 120 HOURS

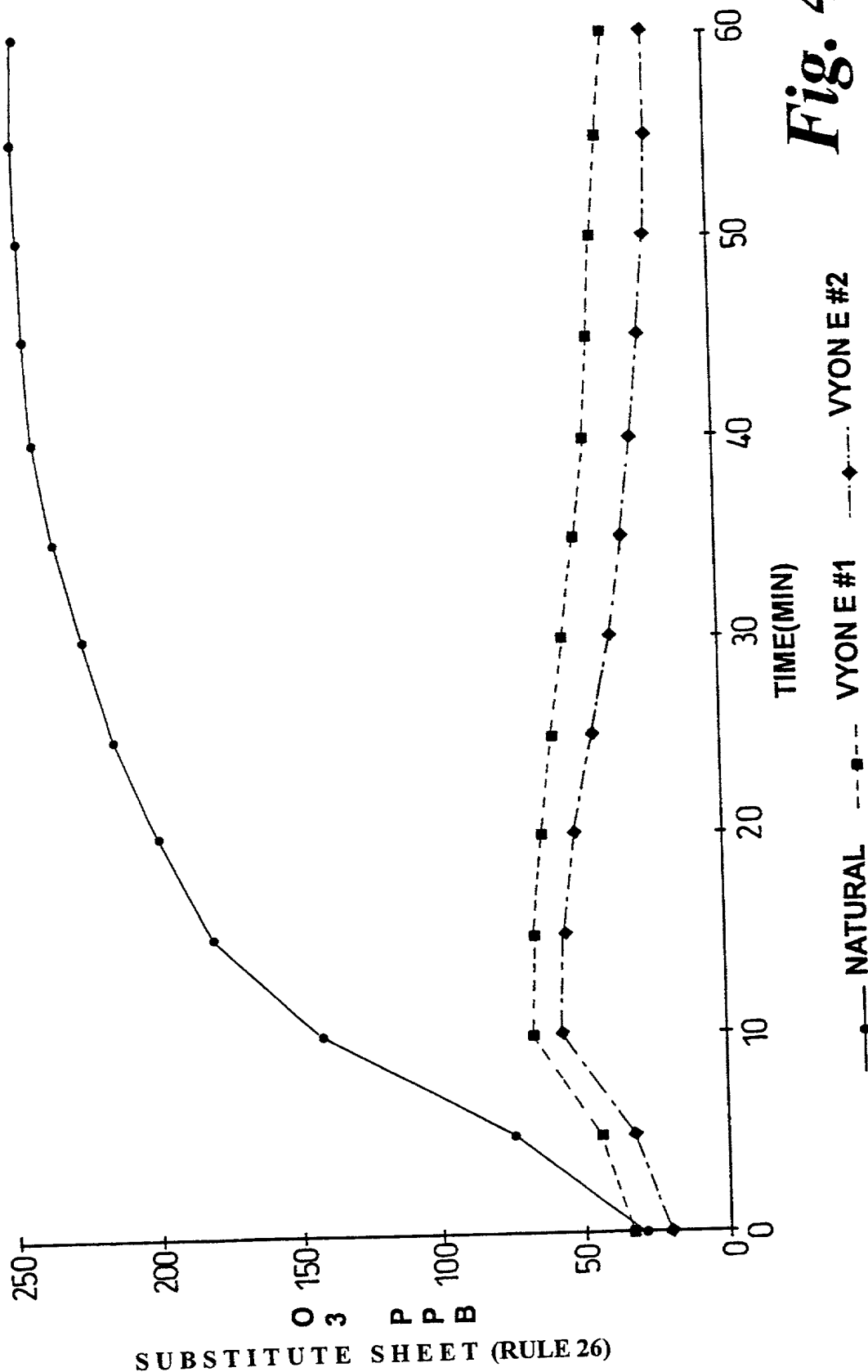


Fig. 4(c)

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REF: O3_9/CHART 5
LINALOOL ON VYON E AFTER 168 HOURS

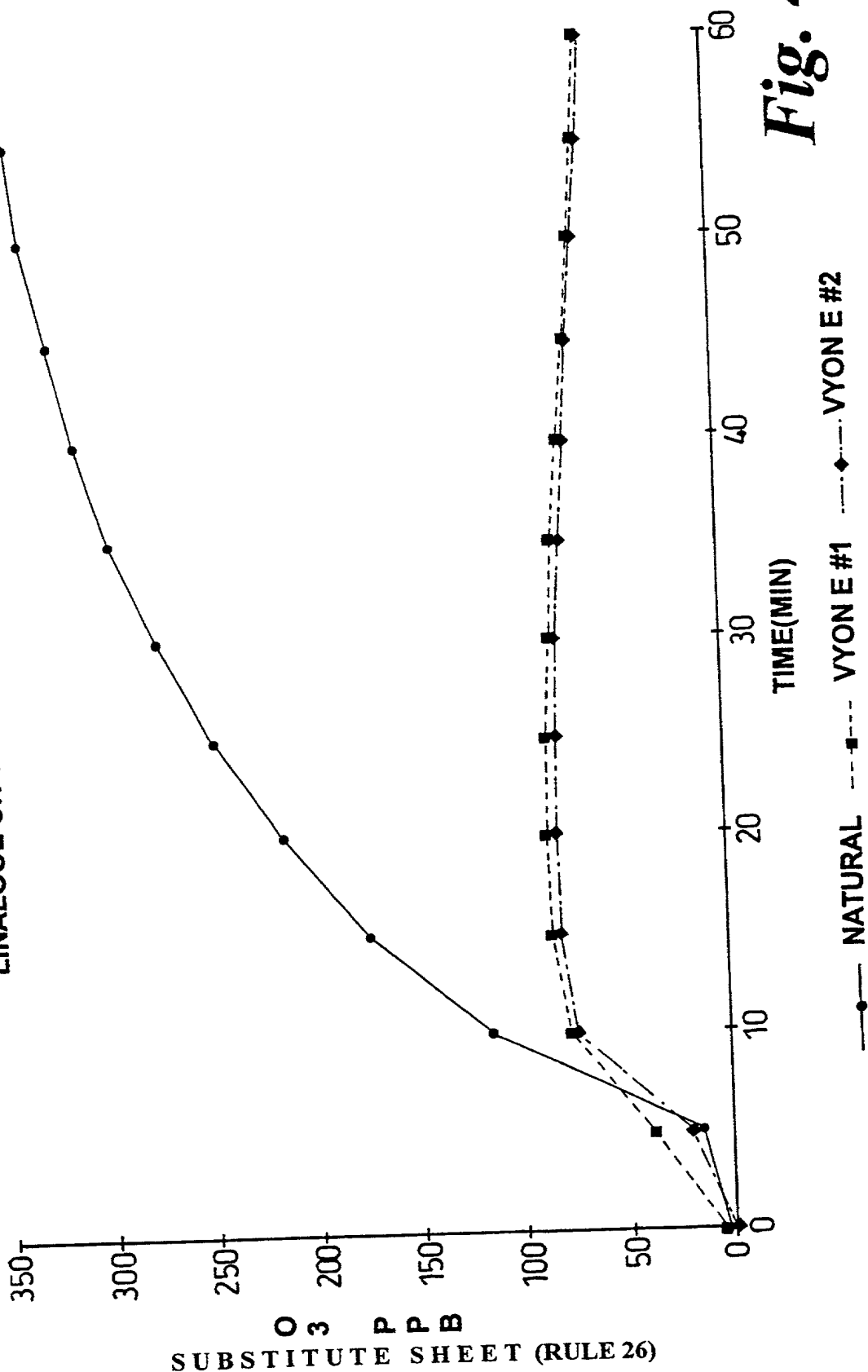


Fig. 4(d)

Reduction of Ozone in an Enclosed Environment

This invention relates to the reduction of ozone in an enclosed environment.

5 The rising number of asthma sufferers in the Western World and in particular in the United Kingdom is a matter of great concern and much research has been done to understand both the causes of the disease and the mechanisms which trigger the onset of an attack.

10 It is known from published papers by RB Devlin et al ("Health Effects of Ozone", Science and Medicine, May/June 1997, pages 8 to 17) and by N A Molfino et al ("Effect of Low Concentrations of Ozone on Inhaled Allergen Responses in Asthmatic Subjects", The Lancet, Volume 338, No. 8761, 15 27 July 1991, pages 199 to 203) that relatively low levels of ozone, similar to those commonly occurring in urban areas, can increase the likelihood of asthma attacks.

Ozone occurs naturally and can for example be caused by thunder storms. Ozone is also created by ultraviolet
20 light. Further, in an office environment levels of ozone can rise significantly due to the ozone produced by electrostatic printing equipment such as laser printers and photocopiers.

The problem of reducing the level of ozone produced by
25 apparatus such as a photocopier or laser printer has been

addressed in US 4,853,735. It has been recognised that such devices are a principle source of ozone in an office environment and thus this document attempts to deal with the problem by reducing the level of ozone near the source i.e. within the apparatus. In order to achieve this a volatile ozone removing agent comprising a mixture of a terpenoid and a glycol family material is used. An ozone removing device is located within the photocopier machine and is designed to provide a controlled flow rate of ozone removing agent. With this arrangement, there are several disadvantages. Firstly the location of the ozone removing agent within the confines of the photocopier means that it will be subject to temperature ranges well outside the normal range of room temperatures and so the evaporation rates will vary accordingly. Another difficulty is that the ozone removing device is a fixture to the photocopier and so will tend to be regarded as a replaceable item for the photocopier, which will require installation, and the device will be priced accordingly. Furthermore, the device requires the use of glycol which is a corrosive material. In addition, ozone is a naturally unstable compound and so, outside working hours, the ozone levels in a room will fall to a baseline level, and thus any evaporation of ozone reducing agent outside working hours is effectively wasted.

US Patent 5,567,416 discloses a slow-volatizing terpenoid composition comprising a mixture of a terpenoid and an anti-oxidant absorbed into a polymeric network material. There are several difficulties associated with this proposal; the substance involved has a relatively low boiling point and uses an additive to raise the flash point of the composition. The additive is dichloropentafluoropropane (HCFC225) which is thought by some to be environmentally undesirable. Furthermore the composition includes an anti-oxidant which is intended to prevent oxidation of the limonene. Since ozone is a powerful oxidizing agent, it is believed that this anti-oxidant may inhibit the reaction of the terpene with ozone.

US Patent 5,256,377 describes an ozone removing device which again is primarily for use in photocopiers. A terpenoid is absorbed onto a support material and subjected to forced ventilation by means of a fan at the outlet of a photocopier.

Japanese Patent Documents JP 1310366, JP 2090184 and JP 62155927 each disclose arrangements in which an ozone removing device is located in or adjacent the exhaust duct of a photocopier.

Accordingly, it is an aim of this invention to provide a passive method and apparatus for controlling the level of

5 ozone in a room or other generally enclosed environment which does not rely on heating or forced ventilation and furthermore which provides a controlled release of ozone reducing agent at a rate commensurate with maintaining the ozone levels in a room housing a photocopier and/or a laser printer at acceptable levels, without requiring the use of potentially harmful additives, so as to make effective use of the ozone reducing agent to provide an extended ozone-reducing effect.

10 Accordingly, in one aspect, this invention provides a method of reducing the level of ozone in a generally enclosed environment, which comprises releasing vapour from a terpenoid or a mixture of terpenoids into the environment at a controlled rate.

15 In studies conducted by the Applicants it has been found that a useful control effect is achieved by releasing the terpenoid vapour at a rate of between 40 and 120mg per hour, more preferably between 60 and 100mg per hour, and ideally about 80mg per hour. The Applicants have
20 determined that a room may be dosed with terpenoid compounds at a required given evaporation rate by careful balancing of the emission characteristics of the support (e.g. void volume, pore size, particulate size etc.) with the evaporation characteristics of the terpenoid compound

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(determined by, e.g. the boiling point temperature) and the amount of terpenoid to be stored. Thus in one preferred example linalool is impregnated into an emission element of Vyton E grade material, and, for the size of emission element used an emission rate of about 80 mg/hour is achieved. More volatile compounds (i.e. with lower boiling points) would need to be used with a less emissive material.

It is preferred for said terpenoid vapour to be released by evaporation from an emission element of absorbent material. The evaporation preferably takes place at normal room temperature (17° C to 25° C) (i.e. no heating is required), such that the evaporation rate, and thus working life of the emission element can be predicted. Likewise evaporation and permeation of the vapour throughout the generally enclosed environment preferably occurs in natural, unforced ventilation (i.e. no fan or confining duct is used).

Preferably said emission element is located in a container configurable between an open position, in which the element is exposed to the ambient atmosphere and a closed position in which said element is generally enclosed within a housing.

Preferably the emission element comprises a porous synthetic polymer structure. The polymer lattice may conveniently be produced by moulding and/or sintering a starting material comprising a synthetic thermo-plastic polymer in particulate form.

In one embodiment, the starting material is a high density polyethylene in which at least 80% by weight of the particles have a particle size within the range of from 1 to 500 micron.

Naturally the size and weight of the emission element depend at least partly on the size of the room to be treated, the volatility of the absorbed liquid and the porosity of the element. In one example said emission element, before absorption of said terpenoid, may typically weigh from 5 to 15 grams. The emission element preferably contains between 10 and 20 grams of terpenoid liquid, and ideally about 15 grams thereof.

The void volume of the emission element may conveniently lie in the range of from 25% to 70% and more preferably between 30% and 55%. In a particular example, the average pore size of the emission element is between 10 and 100 microns.

Preferably the or each terpenoid comprises a terpene or a carotenoid. At least one of the terpenoid compounds

preferably comprises a compound extracted from a plant, or a synthesised compound corresponding to a constituent of a plant extract. Plant extracts that we have found to be suitable are lavender oil, orange oil, grapefruit oil, lime oil, myrtle oil, coriander oil, tea tree oil, elecampane oil, juniper oil, dill oil, lemon oil, elemi oil, spanish sage oil, cypress oil, pine needle oil, lemon balm (melissa) oil, nutmeg oil, ylang ylang oil, basil oil, grapeseed oil, whilst suitable natural or synthesised compounds comprise α phellandrene, α humulene, α terpinene, limonene, α pinene, β caryophyllene, linalool, linalyl acetate, and myrcene.

To enhance safety without requiring the use of modifiers etc., the flash point of the terpenoid compound is preferably greater than 60° C.

Of the compounds set out above we have found linalool to be particularly effective in terms of reaction with ozone and a sustained evaporation rate.

In another aspect, this invention provides the use of at least one of lavender oil, orange oil, grapefruit oil, lime oil, myrtle oil, coriander oil, tea tree oil, elecampane oil, juniper oil, dill oil, lemon oil, elemi oil, spanish sage oil, cypress oil, pine needle oil, lemon balm (melissa) oil, nutmeg oil, ylang ylang oil, basil oil,

grapeseed oil, α phellandrine, α humulene, α terpinene, limonene, α pinene, β caryophyllene, linalool, linalyl acetate, or myrcene for the removal of ozone in a generally enclosed environment.

5 In another aspect, this invention provides apparatus for removing ozone in a generally enclosed environment, said apparatus comprising an emission element of absorbent material impregnated with at least one terpenoid compound located within a container which in use allows free
10 circulation of vapour into said environment.

Preferably said container is reconfigurable between an open operational configuration, in which vapour evaporating from said emission element may dissipate into said environment, and a closed configuration in which said
15 emission element is enclosed.

Advantageously, said container comprises an inner housing having perforate walls, said inner housing being movably mounted with respect to an outer housing. Preferably said emission element comprises a porous polymer
20 substrate impregnated with a terpenoid compound. Said terpenoid compound may advantageously comprise linalool, preferably without additives. Preferably said emission element contains between 10 and 20 grams of linalool. Preferably said emission element has a void volume of

between 25% and 70% and an average pore size of between 10 and 100 microns.

Whilst the invention has been described above it extends to any inventive combination of the features set out above or in the following description.

The invention may be performed in various ways, and an embodiment thereof and certain test results will now be described in detail, reference being made to the accompanying drawings, in which:-

Figure 1 is a front plan view of an ozone removing apparatus in accordance with the invention, in an open position;

Figure 2 is a side view, taken on the left hand side of the apparatus of Figure 1;

Figure 3 is a graph showing the decay of the concentration of ozone in a closed environment (i) naturally and (ii) when an ozone reducing device in accordance with this invention is present, and

Figure 4(a) to 4(d) are comparative graphs showing the build up of ozone in a closed environment containing an ozone generator (i) with natural decay only (ii) with a first example of this invention and (iii) with a second example of this invention, after 72, 96, 120 and 168 hours respectively.

Referring to Figures 1 and 2, a dispenser comprises a perforated housing 10 containing an emission disk or element 12 made of a sheet of an absorbent porous polymer lattice structure available under the Trade Name Vyon Grade E from Porvair Limited, Norfolk, UK. The disk was approximately 90mm in diameter, 5mm thick, and weighed approximately 10 grams. The emission element 12 was left to stand in a dish of a terpenoid (in this example linalool) until saturated. The emission element took up about 15 grams of linalool. The porosity of the support was selected having regard to the volatility of the linalool so that, under normal room temperature conditions, with natural ventilation, the emission element emitted about 80mg of linalool per hour. This gave a theoretical maximum life of 187.5 hours which is equivalent to approximately one month of working hours in a typical office room containing a photocopier.

The perforated housing 10 is pivotally mounted within an outer, imperforate housing 14 having a pivotal attachment, so that the apparatus can be moved between an open position (as shown in Figure 1) and a closed position in which the container is enclosed substantially wholly within the housing 14 thus preventing release of the linalool.

Referring now to Figure 3, this is a graph showing the natural decay rate of ozone and the decay rate with a product in accordance with the invention. In this instance the product included a rectangular emission element of Vyon F material, of 90mm x 70mm and 4.75mm thickness, impregnated with about 15 grams of linalool. It will be seen that the time taken for the ozone concentration to reduce naturally to 50 ppb is over 1000 seconds, whereas with the example of the invention the ozone concentration reduces to 50 ppb in about 260 seconds.

Referring now to Figures 4a to 4d, these are graphs showing the ozone concentration or build up in a closed test environment when an ozone generator is turned on. On each graph there are three traces; the ozone concentration without any ozone removing agent, and the ozone concentration with two examples of the invention (Vyon E#1 and Vyon E#2). In addition to this, the sequence of Figures 4(a) to 4(d) show the characteristics of two examples of the invention after 72, 96, 120 and 168 hours respectively. The examples of the invention comprised Vyon E grade disks 90mm in diameter and 4.75 mm thick, with an original impregnation of about 15gms of linalool. These graphs show individually that the examples of the invention maintain the ozone concentration at a peak level of below

about 75 ppb and generally at about 50 ppb or lower, whereas without the ozone-removing devices the ozone concentration would reach over 200 ppb. The graphs as a set show that the examples of the invention retain their ozone-removing effect substantially unchanged for at least 168 hours. Assuming that the devices are closed outside working hours and that there is no significant evaporation when closed, this means that the examples will continue to be highly effective for at least 21 working days.

As noted above the apparatus emits linalool vapour at a rate of about 80mg per hour, (when the device is open). This emission rate is substantially constant over the life of the pad. Our studies have shown that, in a typical office environment including a photocopier and a laser jet, about 10mg of ozone may be produced per hour. Given the relative molecular weights of linalool and ozone, 32mg of linalool per hour would be required, assuming that each molecule of linalool reacted with an ozone molecule. In practice an excess of linalool is required and for this purpose a factor of between 2 and 3 has been found to work reasonably well. Accordingly it has been found that an evaporation rate of linalool of between 60 to 100mg per hour provides good performance.

These emission rates, together with the sustained extended emission life achieved through careful matching of the properties of the oil with the emission element, provide a particularly effective solution to the problem of maintaining low ozone levels in an office environment. Furthermore, the active agent in the material can be derived from natural sources or be a synthetic derivation thereof, and so is environmentally friendly without requiring additives, which may themselves be seen as environmentally unfriendly, or other substances which may add to the material or manufacturing cost of the device.

Whilst the above embodiment uses linalool on a absorbent pad of Vyon E material, it will of course be appreciated that other terpenoids may be used with other emission elements.

The tables below illustrate the terpenoid compounds which have been tested for their effectiveness in carrying out the present invention. In Table 1, the compounds are shown ranked in order of reactivity, showing the time taken to reduce the concentration of ozone in a standard test atmosphere (100ppb ozone) to 50% of the standard concentration (t100-50) and to 20% of the standard concentration (t100-20).

The tests were carried out with a grade of Vyon material which emitted at a higher rate than Vyon 'E', initially impregnated with 5ml of linalool, but the results are a good illustration of the relative performance of the substances.

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TABLE 1

Essential Oil and Chemical Reactivity

Essential Oil/Chemical	t100-50 (sec)	t100-20 (sec)
Tangerine	112	226
Myrcene	122	261
Mandarin	122	280
Limonene	131	292
Fir needle	132	336
Melissa	163	407
Carrot seed	169	404
Linalool	185	387
Bay	195	526
Dill seed	195	587
Myrtle	200	506
Fennel	201	449
Ravensara	239	567
May Chang	250	524
Inula	260	544
Petitgrain	265	647
Cajeput	276	723
β -pinene	288	653
Coriander	292	571
Manuka	320	756
Clary Sage	320	714
Ho Wood	325	866
Eucalyptus	328	664
Spcarmint	329	776
Citronella	330	>1000
β -Caryophyllene	344	645

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TABLE 1 (cont.1)

Sage	350	>1000
Peppermint	352	730
Ginger	354	814
Niaouli	359	741
Lynalyl acetate	375	736
Myrrh	384	839
Palmarosa	388	892
Spanish sage	392	>1000
Thyme	392	>1000
Geraniol	399	>1000
Valerian	407	785
Cardamon	409	992
Oregano	423	954
Patchouli	460	>1000
Friars Balsam	468	>1000
Terpineol	474	
Nerol	486	>1000
Cinnamon	503	>1000
Citronellol	530	>1000
Ylang Ylang Extra	531	>1000
Geranium	538	>1000
Ylang Ylang	539	>1000
Cedar Wood	539	>1000
Jasmine	584	>1000
Amyris	628	>1000
Citral	647	>1000
Soya	667	>1000
Farnesol	669	>1000
Coconut	673	>1000
Hop Oil	688	>1000

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TABLE 1 (cont.2)

Oleic acid	688	>1000
Carrot tissue	691	>1000
Almond Oil	731	>1000
Clove bud	738	>1000
Hypericum	741	>1000
Hop Extract	742	>1000
Calendula	749	>1000
Borage	768	>1000
Sunflower	771	>1000
Apricot Kernal	784	>1000
Roschip	796	>1000
Grape Seed	808	>1000
Evening Primrose	813	>1000
Clove Stem	827	>1000
Peach Kernal	831	>1000
Rapeseed	841	>1000
Teak	844	>1000
Jojoba	915	>1000
4-allyl anisole	925	>1000
Vetiver	934	>1000
Wheatgerm	943	>1000
Avocado	1002	>1000

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CLAIMS

1. A method of reducing the level of ozone in a generally enclosed environment, which comprises releasing vapour from a terpenoid or a mixture of terpenoids into the environment at a controlled rate.

2. A method according to Claim 1, which comprises releasing the terpenoid vapour at a rate of between 40 and 120mg per hour.

3. A method according to Claim 1 or Claim 2, which comprises releasing the terpenoid vapour at a rate of between 60 and 100mg per hour.

4. A method according to any of the preceding Claims, which comprises releasing the terpenoid vapour at a rate of about 80mg per hour.

5. A method according to any of the preceding claims, wherein said terpenoid vapour is released by evaporation from an emission element.

6. A method according to Claim 5 wherein said terpenoid vapour is released by evaporation from an emission element at normal room temperature (17⁰ C to 25⁰ C).

7. A method according to Claim 5 or 6 wherein said emission element is exposed to natural, unforced ventilation.

8. A method according to any of Claims 5 to 7 wherein said emission element is located in a container configurable between an open position, in which the element is exposed to the ambient atmosphere and a closed position in which said element is generally enclosed within a housing.

9. A method according to any of claims 5 to 8 wherein said emission element is a porous synthetic polymer element.

10. A method according to Claim 8 wherein said synthetic polymer element is produced by moulding and/or sintering a starting material comprising a synthetic thermo-plastic polymer in particulate form.

11. A method according to Claim 10 wherein the starting material is a high density polyethylene.

12. A method according to Claim 9 or Claim 10, in which at least 80% by weight of the particles have a particle size within the range of from 1 to 500 micron.

13. A method according to any of Claims 5 to 12, wherein said emission element, before absorption of said terpenoid, weighs from 5 to 15 grams.

14. A method according to Claim 13 wherein the emission element contains between 10 and 20 grams of terpenoid liquid.

15. A method according to Claim 13, wherein the emission element contains about 15 grams of terpenoid liquid.

16. A method according to any of Claims 5 to 15 wherein the void volume of the emission element is in the range of from 25% to 70% of the volume of the emission element.

17. A method according to Claim 16, wherein the void volume of the emission element is between 30% and 55%.

18. A method according to any of the preceding Claims wherein the average pore size of the emission element is between 10 and 100 microns.

19. A method according to any of the preceding Claims wherein the or each terpenoid comprises a terpene or a carotenoid.

20. A method as claimed in any of the preceding Claims, wherein the terpenoid, or at least one of the terpenoids comprises an essential oil.

21. A method according to any of the preceding claims, wherein the terpenoid compounds or mixture thereof is selected from the group comprising lavender oil, orange oil, grapefruit oil, lime oil, myrtle oil, coriander oil, tea tree oil, elecampane oil, juniper oil, dill oil, lemon oil, elemi oil, spanish sage oil, cypress oil, pine needle oil, lemon balm (melissa) oil, nutmeg oil, ylang ylang oil, basil oil, grapeseed oil, α phellandrene, α humulene, α

terpinene, limonene, α pinene, β caryophyllene, linalool, linalyl acetate.

22. A method according to any of the preceding Claims, wherein the flash point of the or each terpenoid is at least 60°C .

23. Use of at least one of lavender oil, orange oil, grapefruit oil, lime oil, myrtle oil, coriander oil, tea tree oil, elecampane oil, juniper oil, dill oil, lemon oil, elemi oil, spanish sage oil, cypress oil, pine needle oil, lemon balm (melissa) oil, nutmeg oil, ylang ylang oil, basil oil, grapeseed oil, α phellandrine, α humulene, α terpinene, limonene, α pinene, β caryophyllene, linalool, linalyl acetate, or myrcene for the removal of ozone in a generally enclosed environment.

24. Apparatus for removing ozone in a generally enclosed environment, said apparatus comprising an emission element of absorbent material impregnated with at least one terpenoid compound located within a container which in use allows free circulation of vapour into said environment.

25. Apparatus according to Claim 24, wherein said container is reconfigurable between an open operational configuration, in which vapour evaporating from said emission element may dissipate into said environment, and a

closed configuration in which said emission element is enclosed.

26. Apparatus according to Claim 24 or Claim 25, wherein said container comprises an inner housing having perforate walls, said inner housing being movably mounted with respect to an outer housing.

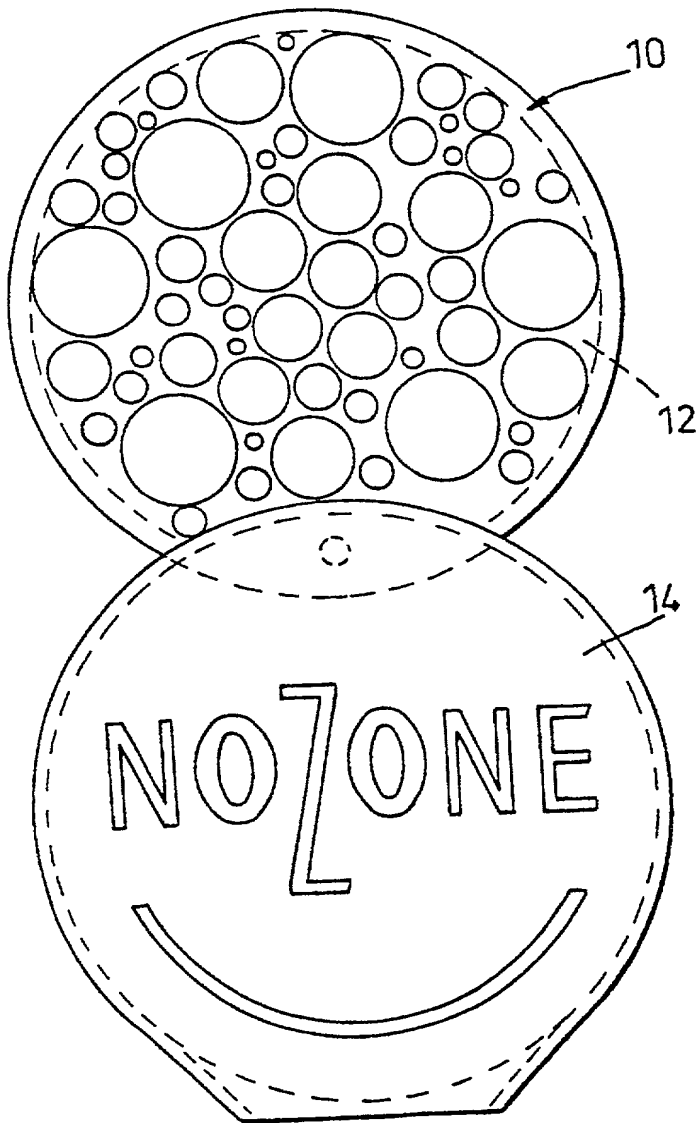
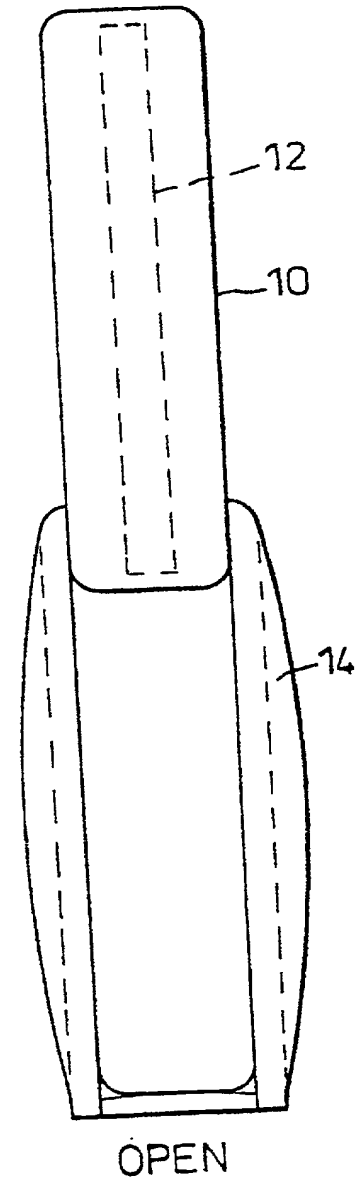
27. Apparatus according to any of Claims 24 to 26, wherein said emission element comprises a porous polymer substrate impregnated with said terpenoid compound.

28. Apparatus according to any of Claims 24 to 27, wherein said terpenoid compound comprises linalool.

29. Apparatus according to any of Claims 24 to 28 wherein said emission element contains between 10 and 20 grams of linalool.

30. Apparatus according to any of Claims 24 to 29, wherein said emission element has a void volume of between 25% and 70% and an average pore size of between 10 and 100 microns.

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**Fig. 1****Fig. 2**

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REF: O3_3/CHART 1
VYON 4.75mm LINALOOL

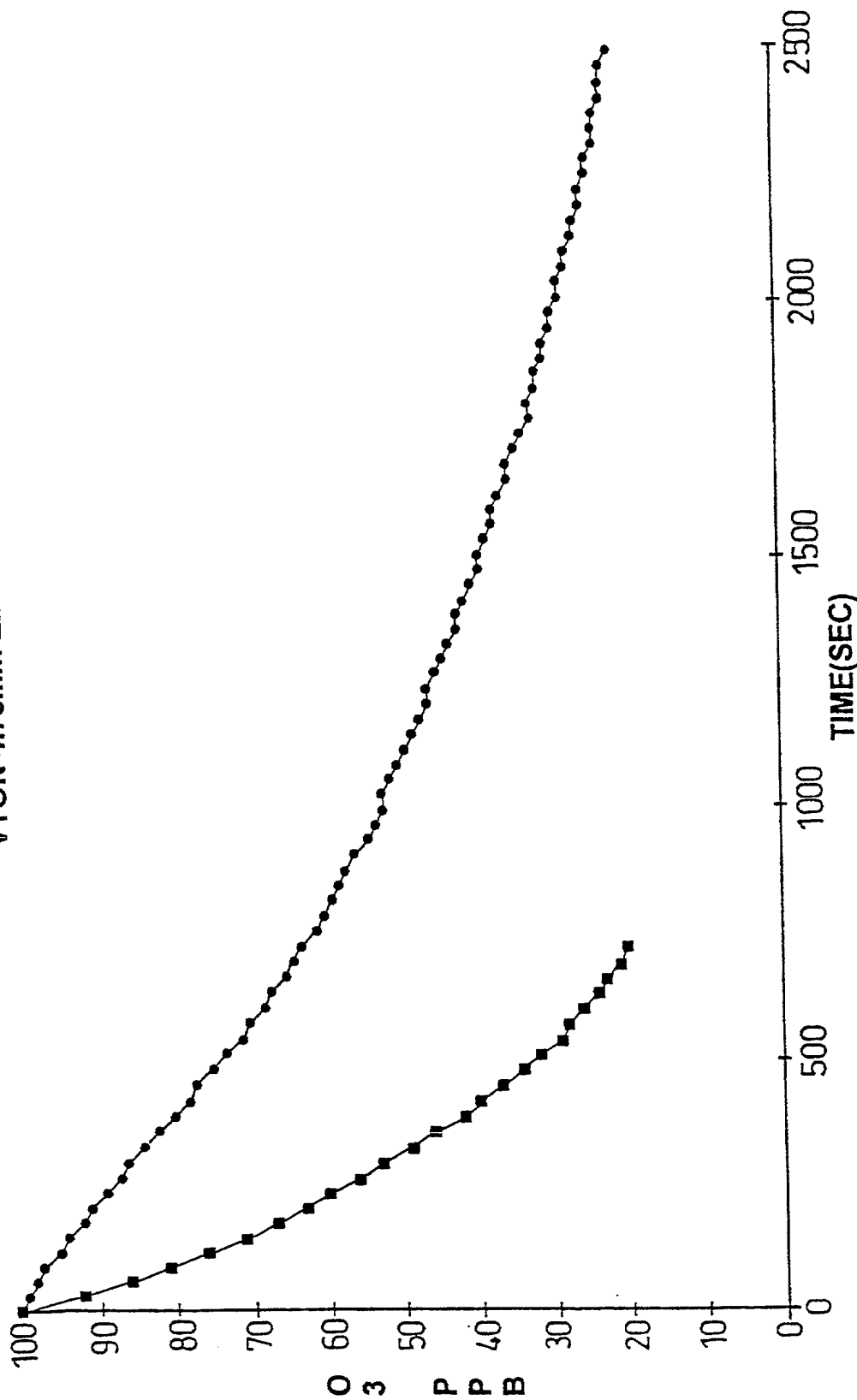


Fig. 3

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REF: O3_9/CHART 2 18/1/99
LINALOOL ON VYONE AFTER 72 HOURS

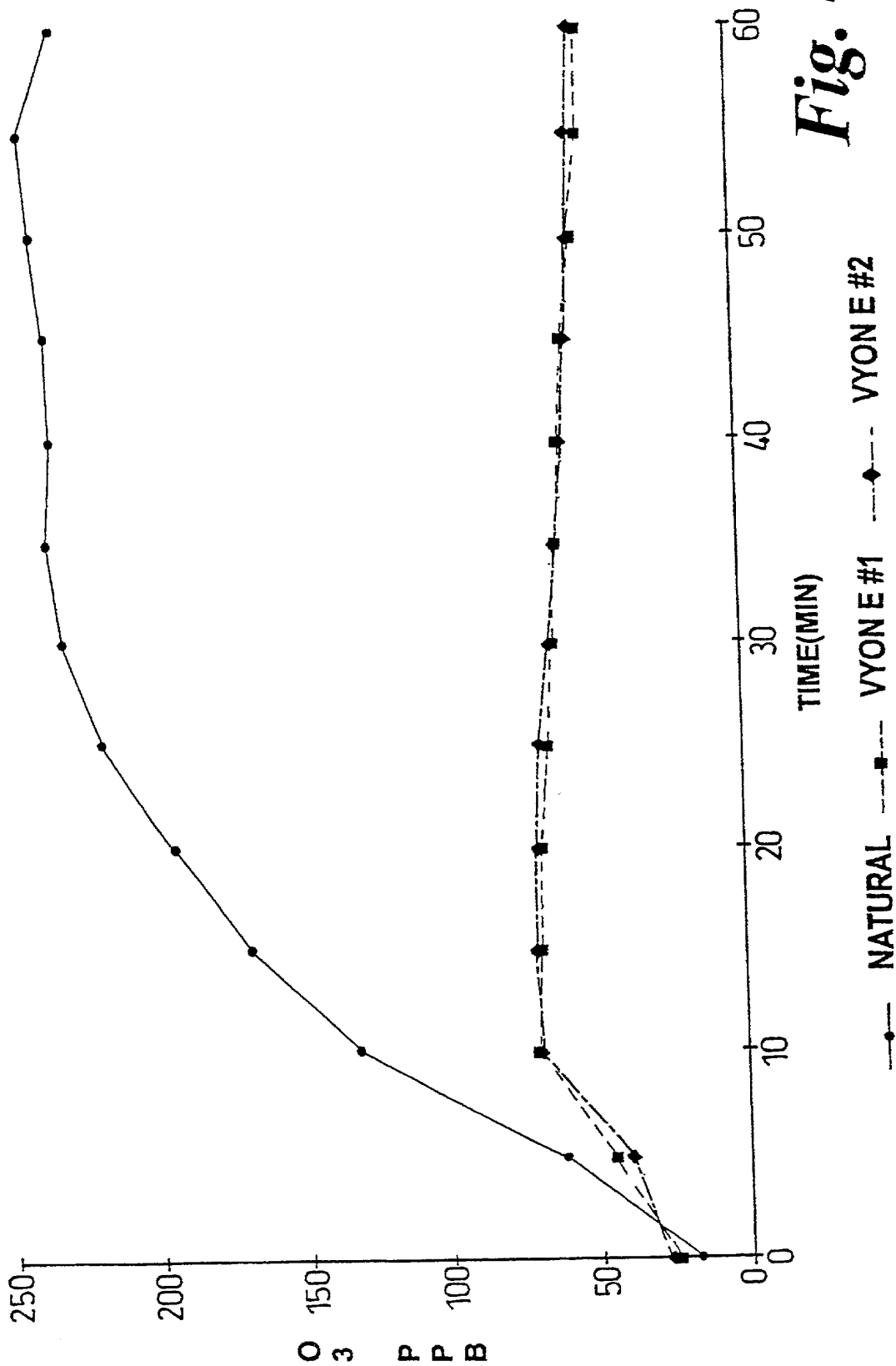


Fig. 4(a)

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REF: O3_9/CHART 3 19/1/99
LINALOOL ON VYON E AFTER 96 HOURS

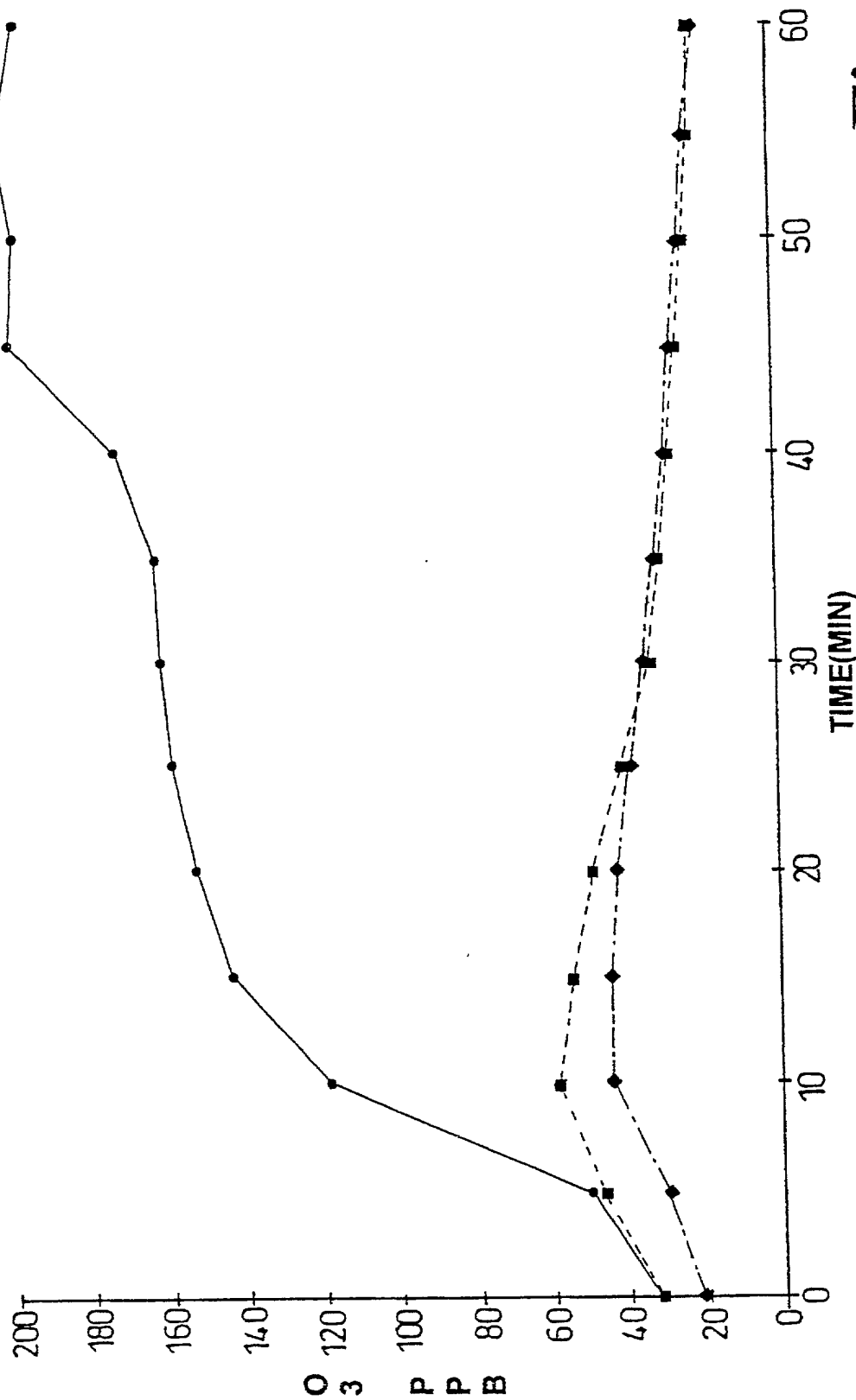


Fig. 4(b)

—●— NATURAL - - - ■ - - - VYON E #1 - - - ◆ - - - VYON E #2

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REF: O3_9/CHART 4 20/1/99
LINALOOL ON VYON E AFTER 120 HOURS

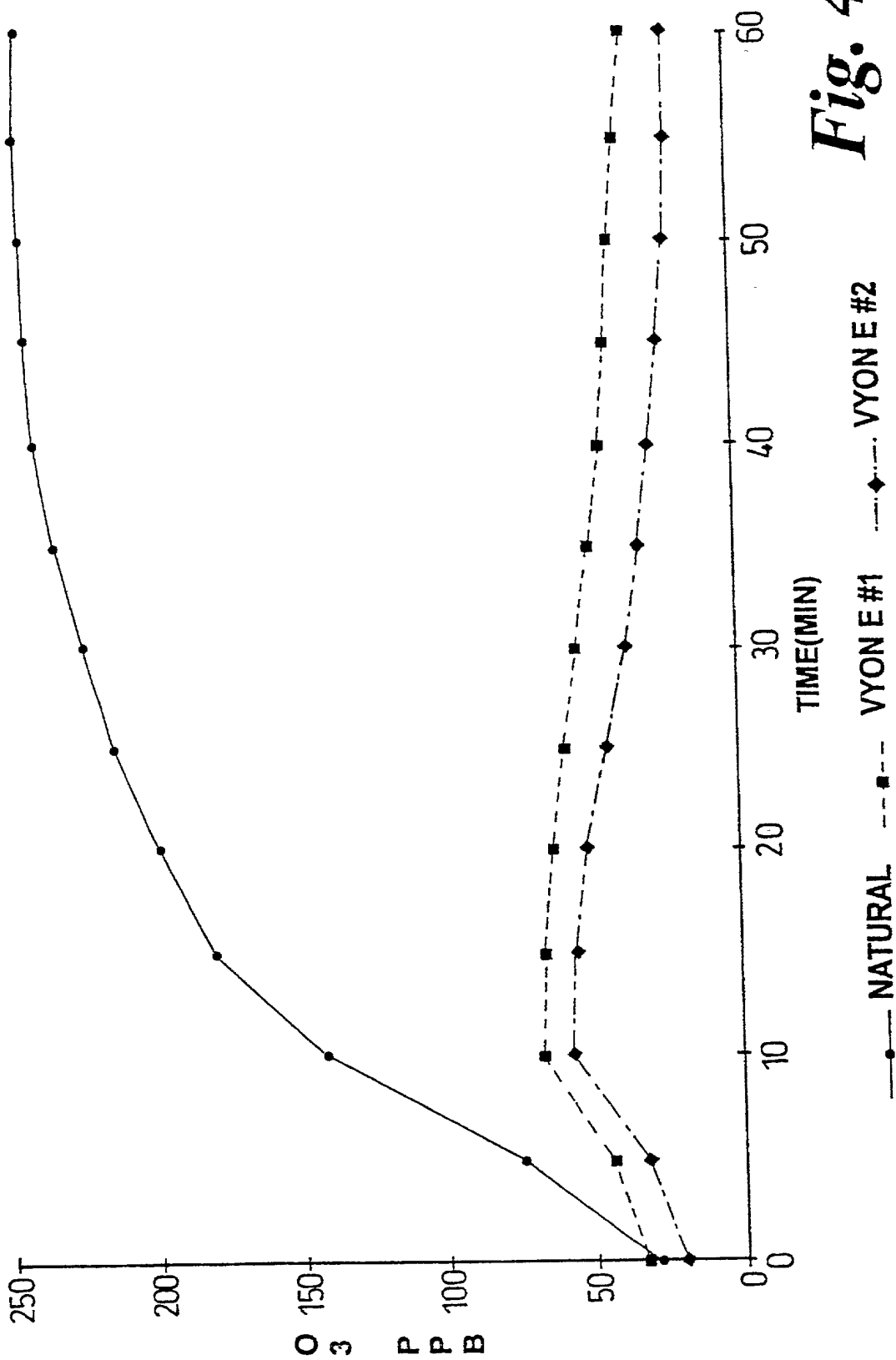


Fig. 4(c)

REF: O3_9/CHART 5
LINALOOL ON VYON E AFTER 168 HOURS

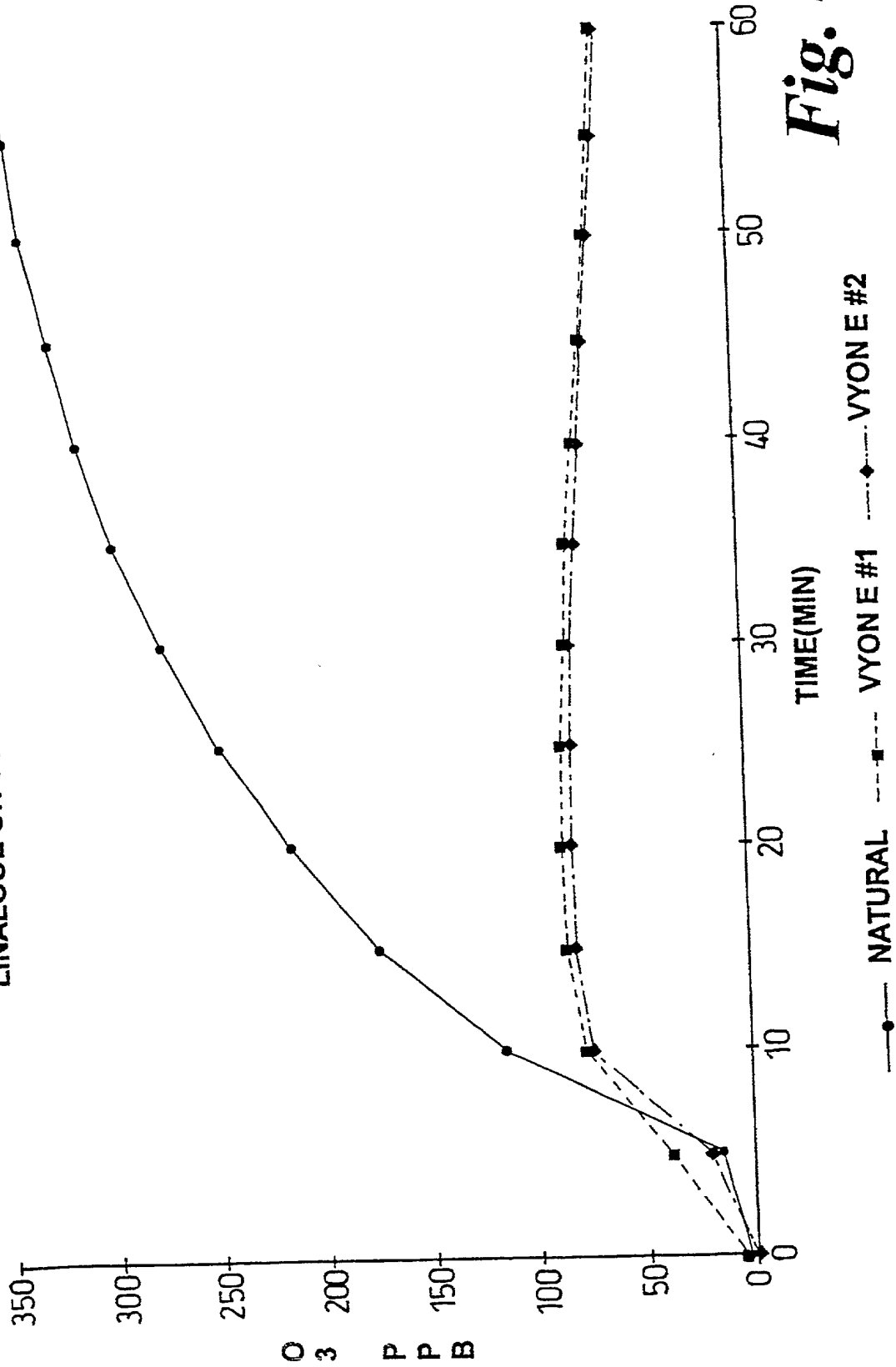


Fig. 4(d)

COMBINED DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

the specification of which: *(check one)*

REGULAR OR DESIGN APPLICATION

- ☐ is attached hereto.
- ☐ was filed on _____ as application Serial No. _____ and was amended on _____ (if applicable).

PCT FILED APPLICATION ENTERING NATIONAL STAGE

- ☒ was described and claimed in International application No. PCT/GB00/02230 filed on 8th June 2000 and as amended on _____ (if any).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

PRIORITY CLAIM

I hereby claim foreign priority benefits under 35 USC 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

PRIOR FOREIGN APPLICATION(S)

Country	Application Number	Date of Filing (day, month, year)	Priority Claimed
United Kingdom	9913357.1	9 th June 1999	Yes

(Complete this part only if this is a continuing application.)

I hereby claim the benefit under 35 USC 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of 35 USC 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)

(Filing Date)

(Status—patented, pending, abandoned)

POWER OF ATTORNEY

The undersigned hereby authorizes the U.S. attorney or agent named herein to accept and follow instructions from **WYNNE-JONES, LAINE & JAMES** as to any action to be taken in the Patent and Trademark Office regarding this application without direct communication between the U.S. attorney or agent and the undersigned. In the event of a change in the persons from whom instructions may be taken, the U.S. attorney or agent named herein will be so notified by the undersigned.

As a named inventor, I hereby appoint the following attorney(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith : **Robert J. PATCH, Reg. No. 17,355, Andrew J. PATCH, Reg. No. 32,925, Robert F. HARGEST, Reg. No. 25,590, Benoît CASTEL, Reg. No. 35,041, Eric JENSEN, Reg. No. 37,855, and Thomas W. PERKINS, Reg. No. 33,027, c/o YOUNG & THOMPSON, Second Floor, 745 South 23rd Street, Arlington, Virginia 22202. Address all telephone calls to Young & Thompson at 703/521-2297.**

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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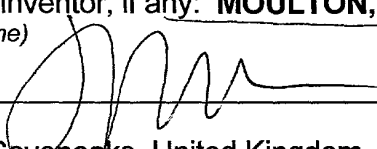
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